Rootstocks for "Difficult" Plants: Rhododendrons, Azaleas and Grevilleas

Michael S. Reid, Wesley P. Hackett and Jason S. Julian

We are now entering the third and final year of funding in our project, which is aimed at providing an economically viable means of producing grafted rhododendrons, azaleas and grevilleas on rootstocks able to tolerate high-pH soils. Ultimately, we hope to develop a reliable procedure by which these beautiful acid-loving shrubs can be produced for introduction into areas with naturally high soil and/or water pH values.

For the production of grafted rhododendrons and azaleas, we have chosen an ecotype of the western rhododendron (*R. occidentale*) for use as a rootstock. Our plant material has been taken from an individual that is currently performing very well under the high pH conditions in Davis. For our research on the grevilleas we have chosen 'silky oak' (*G. robusta*) seedlings as our high-pH tolerant rootstock. Specimen trees can be found in several locations throughout the city of Davis and are performing excellently.

In addition to traditional grafting techniques, we have been experimenting with the establishment of material from both groups in tissue culture. We plan to use this material to test the feasibility of producing grafted individuals through in-vitro mini-grafts.

Progress to date

Our research into producing grafted rhododendrons and azaleas has been primarily impeded by difficulties in the production of large quantities of rootstocks. Time of year and developmental stage have been found to effect the ease of rooting of cuttings used to produce rootstocks. Currently, we have found that it requires almost two months on the mist bench before rooted cuttings are ready to be transplanted and grown-on (Figure 1).

Figure 1. Rooted R. occidentale cutting

We are also working to identify the optimal hormone concentrations and medium composition for rooting of the western rhododendron. We have had little success in rooting through the use of the aero-hydroponics EGS (Ein Gedi System); many of the cuttings were infected with fungi before rooting could occur. We are currently using the optimal rooting protocol to increase the number of rootstocks so that a large quantity of grafts can be completed.

Using Anderson's revised tissue culture medium, we have been able to establish nodal explants of the western rhododendron in culture (Figure 2). More efficient methods for division and multiplication of the rootstock for use in micro-grafting are currently being determined. Work is also being done to establish several commercial cultivars in culture.

Figure 2. R. occidentale in culture

We have met with much greater success in our attempts to generate large numbers of grafted grevilleas. We have found the production of *G. robusta* seedlings from seed purchased through a wholesale seed-farm to be a relatively fast and inexpensive way to produce a good number of rootstocks (Figure 3). While

germination percentages for these seeds have been found to be quite low, the seeds are fairly inexpensive and we have sown extra in order to produce the number of seedlings we require. Seedlings took approximately 45 days to reach transplantable size and were ready to be grafted after another 2-3 months in the greenhouse.

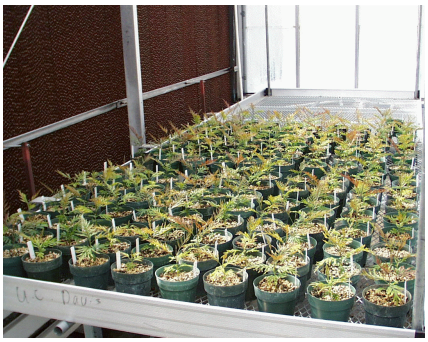

Figure 3. Grevillea robusta seedlings

Attempts to produce rooted cuttings for use as rootstocks were not as successful. Repeated experimentation using the EGS aero-hydroponics system resulted in what appeared to be some callus formation at wound sites in most *G. robusta* cuttings but no rooting. All cuttings died before rooting could occur, usually accompanied by leaf drop and dehydration (Figure 4). Traditional cutting production with hormone application and misting was also attempted multiple times, all producing results similar to those found in the EGS experiments.

Figure 4. G. robusta cuttings in EGS

Using seedling rootstocks we have produced a good number of grafted plants using scion material from several cultivars (Figure 5). Those attempted so far include 'Red Hooks,' 'Ivanhoe,' 'Ruby Clusters,' and 'Constance.'

Figure 5. G. 'Red Hooks' on G. robusta after 2.5 months

We have collected another large group of grevillea cultivars from Bay Area nurseries to use as scion material. These will be tested for compatibility as soon as the next group of seedlings is ready for grafting. So far we have only used simple 'cleft' grafts on the grevilleas. The unions formed through this procedure occur fairly quickly (3 to 4 weeks) and are holding up quite well (Figure 6).

Figure 6. G. 'Red Hooks' on robusta union

During our grafting experiments we have tested for the effects that light and humidity have on the speed and success of the graft unions. Plastic bags with and without aluminum covers have been used to test the effect of light on the grafts while the inclusion or exclusion of a rootstock leaf inside the bags has been used to test the effects of relative humidity (Figure 7). So far it appears as if the complete shading provided by the aluminum covers slows down the process. On average, grafts that have received light have leafed out faster and have developed fewer fungal infections. The effects of humidity in the grafting

enclosure are still unclear.

Figure 7. G. 'Ivanhoe' grafts with leaf addition

In addition to bench grafting grevilleas we have also been working on establishing them in culture. The goal is the same as for the rhododendrons, in that we would like to use established cultures of *G. robusta* and other showy hybrids and cultivars to attempt mini-grafts. As with the rhododendrons, we are still in the in-vitro establishment phase with the grevilleas. Initial explants of *G. robusta* have been successful so far, but techniques and media for subdivision are still being developed (Figure 8).

Figure 8. G. robusta in culture

During this final year of funding we plan to complete several goals with regards to our work on the grevilleas. First, we will continue to prepare grafted plants in the greenhouse using the new cultivars that we have recently collected. Once the grafted plants are well established they will be planted out in test plots on campus, primarily within the Australian Natives section of the U.C. Davis Arboretum. Here we will be able to monitor their progress and watch for any signs of nutrient disorders or incompatibilities. Also, once we have determined the best procedures for preparing and maintaining the grevillea explants in culture, we will test the commercial applicability of using mini-grafts in the production of grafted grevilleas.

With the rhododendrons and azaleas, our primary concern is to determine the most successful and efficient means of propagating *R. occidentale* rootstock. Once we have enough rootstock plants to conduct sizable grafting experiments we will test scion material from several commercial cultivars for compatibility. Again, established grafted plants will be planted in our test gardens and monitored. Tissue culture experiments will continue with the hope of establishing a reliable division and multiplication system, from which we will be able to test the viability of micrografting in the production of grafted rhododendrons.

Michael S. Reid is professor, Wesley P. Hackett is professor emeritus and Jason S. Julian is graduate student in the department of environmental horticulture at the University of California, Davis.